

A 128-Channel Compact VUV Spectrometer for Wide-Temperature Entry Descent & Landing Sensing Applications, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

NASA manned and robotic missions to the surface of planetary or airless bodies require Entry, Descent, and Landing (EDL). For many of these missions, EDL represents one of the riskiest phases of the mission. Despite the criticality of the EDL phase, NASA has historically gathered limited engineering data from such missions, and use of the data for real-time Guidance, Navigation and Control (GN&C) during EDL for precise landing (aside from Earth) has also been limited.

NASA scientists have identified a compact vacuum ultraviolet spectrometer as a key enhancement to EDL sensing.

Ozark IC has developed a far-ultraviolet focal plane array (FPA) in SiC BiCMOS technology. The 159x64 pixel FPA has a spectral response from 100[JH1] nm to 350 nm. BiCMOS test circuits in this technology have demonstrated operation for 100 hours at 500°C suggesting this FPA will not require any active cooling to operate. The key feasibility question to be answered is: *Can the high-temperature packaging and optics be designed with a maximum dimension of 10 centimeters?*

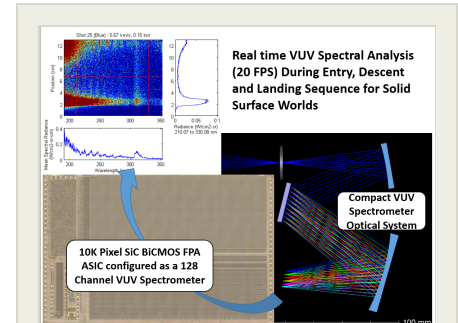
The primary objective is to answer the feasibility question through a series of measurement and design tasks. Ozark IC will develop supporting FPA firmware and software for environmental testing of the FPA. LumenFlow will then design the spectrometer optics for the smallest possible form factor. Ozark IC will apply it's high-temperature ceramic packing solutions to design a high-temperature substrate and connector system for the SiC FPA and investigate enclosure materials.

Objectives of Phase I

1. Determine coldest possible operating temperature of the SiC FPA (cryogenic testing)
2. Operate the SiC FPA as a spectrometer using representative spectral lines
3. Investigate design trade-offs of thermally matched ceramic substrates for SiC FPA ASIC
4. Design compact spectrometer components and verify with optical simulation
5. Design VUV experiments to validate the optical system and identify design apparatus needed to complete the experiment

Anticipated Benefits

NASA requires compact VUV spectrometer for EDL sensors to:



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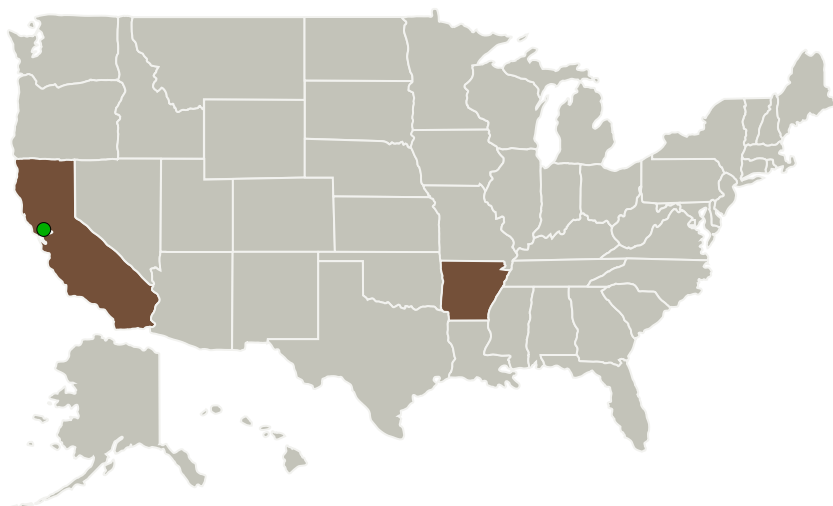
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- Understand the in-situ entry environment.
- Characterize the performance of entry vehicles.
- Make autonomous and real-time onboard GN&C decisions to ensure a precise landing.

Scientific Research: molecular research, ionic atmosphere analysis, ocean analyses. **Heat:** fire detection, sunburn protection, and diesel engine combustion analysis. **Disinfection:** UV light kills pathogens. UV spectrometry determines which wavelengths are being used and, therefore, which pathogens are being attacked in food, air, water disinfection systems. **Quality Control:** Looking for small imperfections, especially with very small dimensions in assembly lines and machine vision.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ozark Integrated Circuits, Inc.	Lead Organization	Industry	Fayetteville, Arkansas
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ozark Integrated Circuits, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

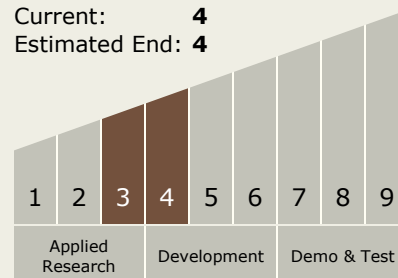
Carlos Torrez

Principal Investigator:

James A Holmes

Technology Maturity (TRL)

Start: 3
Current: 4
Estimated End: 4



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Primary U.S. Work Locations

Arkansas

California

Project Transitions



July 2018: Project Start

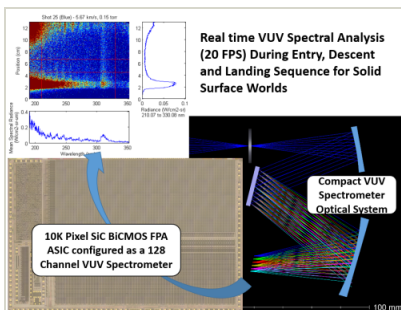


February 2019: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/141192>)

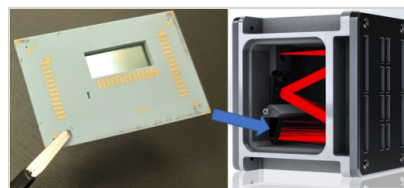
Images



Briefing Chart Image

A 128-Channel Compact VUV Spectrometer for Wide-Temperature Entry Descent & Landing Sensing Applications, Phase I

(<https://techport.nasa.gov/image/134233>)



Final Summary Chart Image

A 128-Channel Compact VUV Spectrometer for Wide-Temperature Entry Descent & Landing Sensing Applications, Phase I

(<https://techport.nasa.gov/image/128689>)

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - TX09.4 Vehicle Systems
 - TX09.4.4 Atmosphere and Surface Characterization

Target Destinations

The Moon, Mars, Others Inside the Solar System